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Exhaust Emissions from Twenty Light Duty Diesel Trucks

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16. ABSTRACT

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The test vehicles were randomly selected from the general public in the St. Louis area using direct appeals to individual owners and referrals from other test participants. The test sequence included the Federal Test Procedure, the Highway Fuel Economy Test and several short tests. Mass emissions were also measured during individual steady state and transient modes of operation. The work was conducted during March and April of 1980.

The average emission test results were very low and similar to those from diesel engines in passenger cars. It appears that diesel engines in light duty truck service demonstrate virtually no emission deterioration while in-use over their "useful life" although two engines required major engine rebuilding before 50,000 miles.

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by
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August 1980

Test and Evaluation Branch
Emission Control Technology Division
Office of Mobile Source Air Pollution Control
U. S. Environmental Protection Agency

Abstract

This paper describes the results of an exhaust emission testing program conducted for EPA by Automotive Testing Laboratories. Twenty diesel-powered light-duty trucks were tested. Gross vehicle weight ratings for these trucks ranged from 5300 to 6200 lbs. The primary purpose of this program was to provide data to establish emission factors for light duty diesel-powered trucks. Secondary objectives included an assessment of the emission durability of the engines and an evaluation of fuel economy.

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Introduction

The diesel engine has long been recognized as a fuel-efficient and durable powerplant. However, its use in light-duty trucks and passenger cars has been limited because of a number of factors: primarily weight, noise and cost. Prior to the 1976 model year, there were no major American manufacturers involved in the production of light-duty diesel trucks. The changing economic and political situations, especially with regard to the cost and availability of crude oil as well as fuel economy legislation, has made this concept more feasible. Since their introduction in 1978, General Motors 5.7 liter (350 CID) diesel engines have received wide acceptance both as a light duty truck and passenger car engine.

Purpose

The purpose of this program was to gather data on in-use light-duty diesel-powered trucks. These data will provide needed information to establish emission factors, assess the emission durability of these types of vehicles, and measure their fuel economy.

Program Design

This program was similar in design to larger emission factor projects in that vehicles were selected from the general public and tested in as-received condition. Due to the difficulty in determining which light-duty trucks were diesel-powered, the vehicles were solicited by means of media advertising and referrals from other participants.

The following incentives were offered to the owner of candidate vehicles:

1. A $50 U. S. Savings Bond
2. The use of a late-model loaner vehicle during the period of the test
3. A full tank of fuel for the test vehicle upon return to its owner.

The test vehicles were delivered to the laboratory by their owners. During vehicle check-in, the truck was examined to confirm its compliance with sample specifications and to assure its suitability for testing. Following this inspection, vehicle exchange agreements were completed. An EPA-furnished questionnaire, which sought information about vehicle usage and maintenance frequency, was administered to the owner. Prior to testing, each test vehicle was drained, refueled to 40% of tank capacity, preconditioned and driven to the soak area. Each vehicle remained in the soak area with its engine off for between twelve and twenty-four hours. The temperature of the soak area was maintained between 68°F and 86°F.

Each vehicle was tested according to to the following test sequence.

1. Federal Test Procedure (FTP)
2. Highway Fuel Economy Test (HFET)

3. Three Short Cycle Tests (Federal Short Cycle, Idle test, Federal Three Mode test)

4. Modal Test (Steady States and Accel/Decel sequence)

After testing was completed, an inspection of emission-related components was conducted. The vehicle was then refueled to capacity and returned to its owner.

Vehicle Testing Procedures

Federal Test Procedure (FTP) - The FTP for diesel-powered vehicles was conducted in general accordance with the light-duty diesel test procedure described in 40 Federal Register 126. It differs from the FTP for gasoline-powered vehicles in that a heated FID was used for measurement of hydrocarbon emissions. A remote CVS dilution air filter assembly was situated as close to the vehicle as possible (replacing the CVS filter installed in the constant volume sampler). The heated FID continuously measured exhaust hydrocarbons immediately downstream of the diesel exhaust/dilution air mixing point. These continuous measurements, which were averaged over each test segment, were used in place of hydrocarbon measurements from the CVS sample bag. The dynamometer inertia weight setting used was the same as used by the manufacturer for certification. The actual dynamometer horsepower was derived from the frontal area for each vehicle supplied to EPA by the manufacturer. The results of the FTP on individual vehicles are listed in Appendix A. The heated FID, remote dilution air box and continuous diesel exhaust hydrocarbon sampling procedures were also used for the Highway Fuel Economy Test and the Federal Short Cycle Test.

Highway Fuel Economy Test (HFET) - The HFET followed the FTP with the engine at normal operating temperature. The vehicle was first preconditioned on the dynamometer at 50 mph for three minutes. Within one minute of the end of preconditioning, the truck was brought to idle and the test begun. One sample was taken during the HFET which is 765 seconds long and covers 10.2 miles. Fuel economy was calculated from emission results using the carbon balance equation. Load settings and inertia weights were identical to those used for the Federal Test Procedure. Results of this test are listed in Appendix B.

Modal Testing - The modal exhaust emission measurements were made up of two separate tests: steady states sampled at idle and 5, 10, 15, 30, 45, and 60 miles per hour and the Surveillance Driving Sequence which consists of thirty-two accel/decel modes each of which is separated by a constant speed mode. Load settings and inertia weights were identical to those used for the Federal Test Procedure. Idle and steady state results for each vehicle are listed in Appendix C. Table 4 contains a summary of the thirty-two accel/ decel modes. The individual results for the SDS are contained in the final report on the overall program (reference 1).

Federal Short Cycle Test Procedure - The Federal Short Cycle Test was performed on all vehicles. This nine mode test is 125 seconds long and covers a distance of 0.75 miles. Inertia weight, horsepower loads, and manual transmission shift points were the same as prescribed for the Federal Test Procedure.

The test was preceded by a six-minute idle period with the engine compartment open. At the end of the six-minute idle, the test was started. These results are listed in Appendix D.

Idle Test Procedure - For this test, undiluted tailpipe exhaust is sampled using portable analyzers with the engine at idle and the transmission in neutral. Equilibrium of engine rpm and the undiluted CO, HC and NO readings were maintained before the readings were recorded. The Idle Test was preceded by a six-minute soak at idle with the engine compartment open. Results from this test are listed in Appendix E.

Federal Three Mode Test Procedure - For the Three Mode Test, undiluted tailpipe exhaust was sampled during three steady state operating conditions; high speed, low speed and idle. The dynamometer load simulated the average power which occurs at the appropriate speed on the FTP, with all light-duty vehicles being grouped into weight classes. The inertia weight was set at 1750. Dynamometer load was set a specified horsepower for the high speed mode and a different horsepower for the low speed mode. A six-minute soak with the engine compartment open and engine idling preceded the Three Mode Test.

Discussion

Test Results - Complete FTP and HFET results for each truck are attached as Appendices A and B, respectively. Average results are displayed as histograms in Figure 1. Except for HC results on one truck, all FTP emission values are within the 1979 Federal Standards. This is quite remarkable considering that four of the trucks were certified by the heavy duty test procedure and six of the trucks by the less stringent 1977-78 light duty test procedure which allowed lower dynamometer horsepower settings. Average exhaust emission results by model year and trucks meeting 1979 Federal Standards are attached as Table 1. The average emission levels of these trucks compare closely to results of other testing on diesel passenger cars performed in the FY75 and FY77 Emission Factors Programs. They also compare closely with the twenty 1978 Oldsmobile Diesels tested at EPA's lab in Ann Arbor earlier this year. In the FY77 program, a total of nineteen Mercedes-Benz and one Peugeot diesel passenger cars were tested. In the FY75 EF diesel testing, all twenty were Mercedes-Benz. The model years ranged from 1964 to 1977 for the FY75 and FY77 EF Programs. Listed in Table 2 are the average emission values of: 1) FY78 EF Diesel Trucks, 2) EPA Olds Diesel Cars, 3) the vehicles tested in the FY75 and FY77 Emission Factors Programs.

Short cycles - The data generated from the Federal Short Cycle, Two Speed Idle, and the Federal Three-Mode test showed very low emissions with little variance from vehicle to vehicle. The complete short cycle results are attached as Appendices D, E and F.

Fuel Economy - Miles-per-gallon (mpg) figures over both the FTP and HFET were calculated for each test. Due to the fact that the test horsepower for all trucks tested were determined by the frontal area method applicable to only 1979 and later models, it was only possible to compare the test results of the 1979's with the EPA Gas Mileage Guide. Ten 1979 Chevrolet and GMC Trucks were in this category. The average values are displayed in Figure 2. The test results showed that they averaged about 93% of the Guide's FTP values and 88% of the HFET. The questionnaire completed by each of these owners included questions which asked for the owner's estimate of the vehicle's fuel economy under city, highway, and combined driving conditions.

Of those that responded, the owners' figures were 103% of the Guide values for the FTP, 86% for the HFET, and 91% for the combined mileage values. Responses of the owners were also compared to the actual test numbers generated in this program. In this case, the owner's estimates were 110% of the FTP, 98% of the HFET, and 102% of the combined. The fuel economy on individual vehicles are listed in Table 3. The HFET emission results along with the emission test parameters are listed in Appendix B.

Participant Profile - Most owners were satisfied with the performance of their vehicle's engine although some had experienced major problems with internal engine parts, injector pumps, injectors, transmission and cooling lines, as well as oil leaks. Two trucks required major engine rebuilding before 50,000 miles. All except one felt that they had maintained their vehicles in accordance with manufacturer's recommendations. A listing of these responses is attached as Appendix G.

Conclusions

Based on the results of this effort, it appears that these diesel engines exhibit low exhaust emission levels with no significant deterioration. Some shortfall in fuel economy was noted although the owners' estimates were consistent with the actual values from the test.

References:

1. "Study of Emissions from 1975-1979 Light Duty Trucks", EPA-460/3-80-008 March, 1980

Figure 1
Testing of 1977-1979 Diesel Trucks
20 Trucks

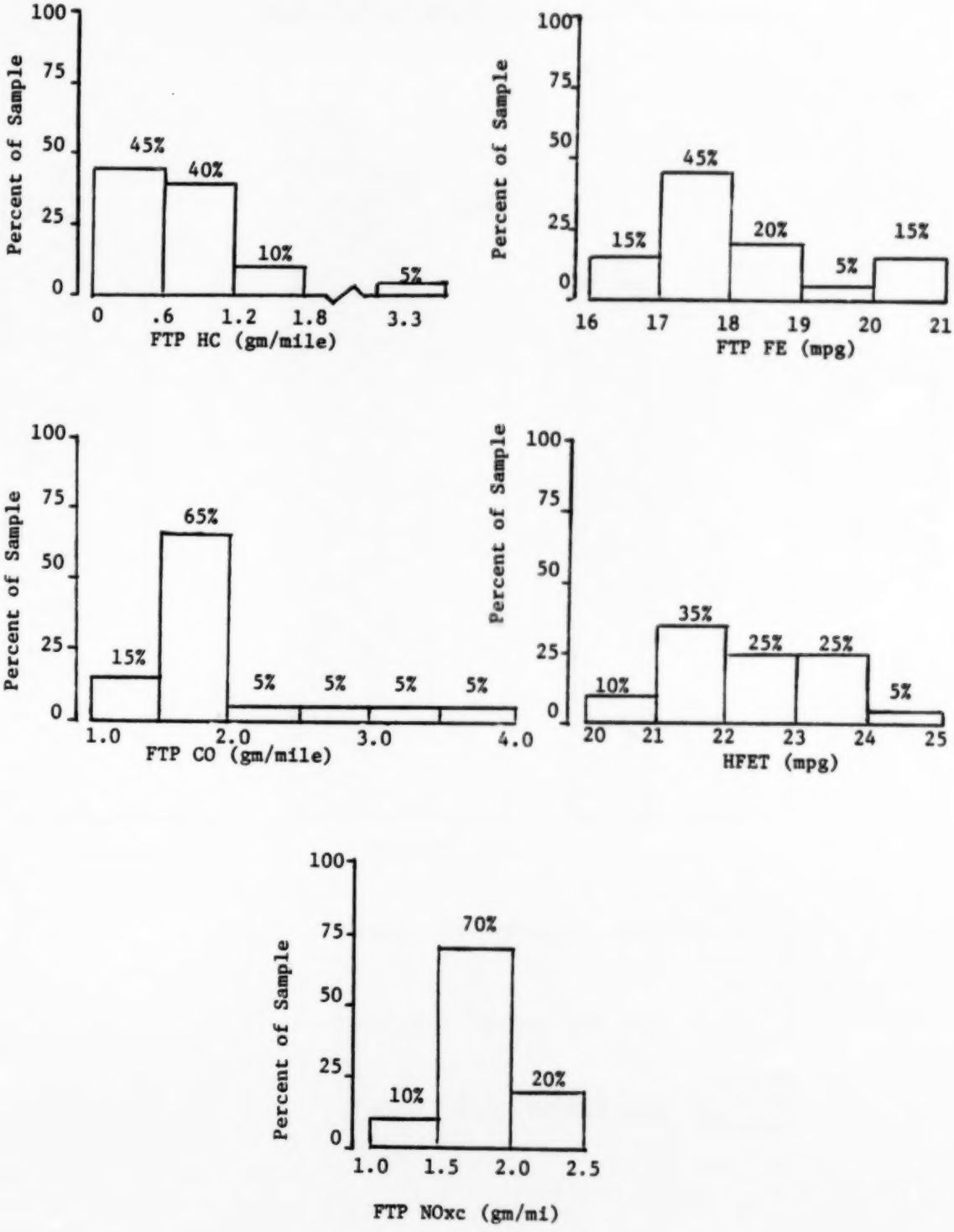

Figure 2

AVERAGE FUEL ECONOMY FOR 10 1979 MODEL YEAR

CHEVROLET AND GMC TRUCKS ENGINE FAMILY 932J9

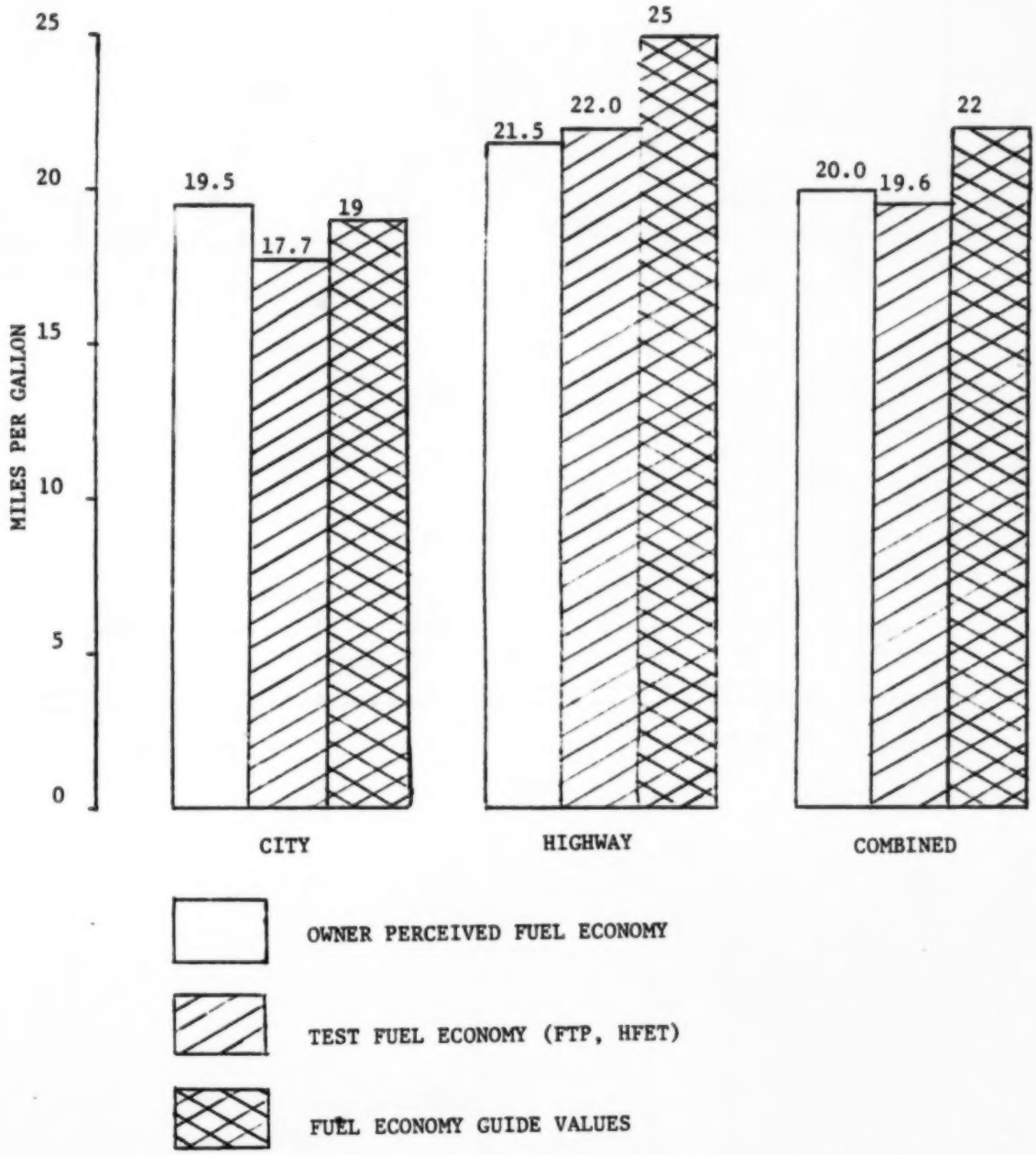

TABLE 1

EXHAUST EMISSION TEST RESULTS FOR DIESEL TRUCKS

ST. LOUIS DIESELS

1979 FEDERAL TEST PROCEDURE

MODEL YEAR	VEH	AVERAGE ODOM	HC	CO	CO_2	NO_{xc}	FUEL ECONOMY FTP	FUEL ECONOMY HFET
1975	0							
1976	0							
1977	2	66289	2.40	3.20	476.2	1.91	20.82	24.10
1978	8	30109	0.80	1.91	560.6	1.79	17.97	21.82
1979	10	9593	0.63	1.76	569.8	1.79	17.71	21.98
TOTAL	20	23469	0.87	1.97	556.8	1.80	18.09	22.11

EMISSION RESULTS ARE IN GRAMS PER MILE
FUEL ECONOMY IS IN MILES PER GALLON

DIESEL TRUCKS MEETING 1979 FEDERAL STANDARDS

MODEL YEAR	NO. VEH	HC ≤1.7 gm/mi NO.	HC PCT	CO ≤18 gm/mi NO.	CO PCT	NO_{xc} ≤2.3 gm/mi NO.	NO_{xc} PCT	PASSED ALL THREE NO.	PASSED ALL THREE PCT
1975	0								
1976	0								
1977	2	1	50	2	100	2	100	1	50
1978	8	8	100	8	100	8	100	8	100
1979	10	10	100	10	100	10	100	10	100
TOTAL	20	19	95	20	100	20	100	19	95

Table 2
Average Test Results

	N	Odometer	FTP (gm/mi) HC	CO	NOx	Fuel Economy (mpg) FTP	HFET
FY78 E.F. Trucks	20	23469	.87	1.97	1.80	18.1	22.1
EPA Olds Cars	20	48194	.83	1.63	1.40	21.3	31.3
FY75 E.F. Cars	20	76473	.80	2.2	1.60	23.9	29.8
FY77 E.F. Cars	20	86318	1.12	2.9	1.43	24.2	31.3

The data generated from the short cycle tests showed very low emissions with little variance from vehicle to vehicle. Complete short cycle results are attached as Appendices D, E, and F.

Table 3
Listing of Fuel Economy on Individual Trucks

Veh. No.	Model Year	Make	Model	CID	Miles per Gallon (minutes per gallon for idle) Idle	5 mph	10 mph	15 mph	30 mph	45 mph	60 mph	FTP	HFET
1376	1978	GMC	C150	350	154.1	8.7	17.6	25.4	24.7	25.0	20.7	16.3	22.4
1377	1978	Chev	C10	350	112.5	10.7	19.9	28.1	32.3	26.4	21.0	18.2	23.2
1378	1977	IH	Scout	198	339.8	26.4	26.5	23.3	30.1	29.7	21.3	20.9	23.4
1379	1979	GMC	C150	350	112.2	9.5	18.7	27.5	31.1	25.6	20.1	17.9	22.2
1380	1978	Chev	C10	350	135.9	12.0	19.3	27.3	31.1	26.3	20.6	18.1	23.1
1381	1977	IH	Trav	198	314.8	23.4	21.6	18.9	26.6	31.9	22.2	20.8	24.8
1382	1979	Chev	C10	350	136.5	11.9	16.9	24.5	28.7	23.9	18.9	17.4	21.1
1383	1978	IH	Scout	198	294.4	20.2	21.4	31.1	32.7	25.1	18.2	20.6	21.2
1384	1979	Chev	C10	350	114.4	10.0	17.6	26.1	30.1	26.1	20.1	18.7	22.5
1385	1979	GMC	C150	350	120.3	10.4	19.4	28.5	32.0	26.7	21.7	18.7	23.5
1386	1978	MERB	207D	146	342.1	14.6	24.4	21.5	25.9	26.4	18.3	19.3	21.4
1387	1979	GMC	C150	350	104.5	9.0	17.3	25.3	29.4	25.2	20.1	16.4	21.8
1388	1979	Chev	C10	350	111.7	9.6	18.0	25.0	27.9	23.6	19.4	17.0	20.7
1389	1979	GMC	C150	350	120.4	10.5	22.2	25.3	29.1	25.1	19.8	17.9	21.9
1390	1978	GMC	C150	350	114.7	10.1	19.4	19.8	26.4	25.9	20.4	17.5	22.3
1391	1979	Chev	C10	350	112.8	9.7	18.3	25.9	29.9	25.8	20.7	17.6	22.1
1392	1979	Chev	C10	350	113.1	9.5	20.1	26.9	30.5	25.5	19.3	18.0	21.8
1393	1979	GMC	C150	350	118.2	10.2	17.6	25.5	30.0	26.2	21.1	17.9	22.4
1394	1978	Chev	C10	350	139.5	13.2	16.8	25.0	29.3	24.6	17.4	17.0	20.1
1395	1978	GMC	C150	350	113.9	9.8	20.9	25.9	29.9	24.9	18.9	17.5	21.2
			Harmonic mean		136.9	11.3	19.4	25.0	29.2	25.9	19.9	18.1	22.1

Table 4

Summary Of Modal Results on Diesel Trucks (Legend)

SURVEILLANCE DRIVING SEQUENCE

No	Mode Type	Speed Range (mph)	Time in Mode (sec)	Average Speed (mph)	Average Acceleration Rate (mph/sec)	Distance (miles)
1	Accel	0-30	12	18.05	2.50	0.0602
2	Decel	30-0	16	16.66	-1.88	0.0741
3	Accel	0-15	8	9.04	1.88	0.0201
4	Accel	15-30	11	23.07	1.36	0.0705
5	Accel	30-45	13	37.65	1.15	0.1360
6	Decel	45-30	12	38.05	-1.25	0.1268
7	Accel	30-60	17	45.80	1.76	0.2163
8	Decel	60-45	12	51.48	-1.25	0.1716
9	Accel	45-60	14	52.54	1.07	0.2043
10	Decel	60-15	30	40.40	-1.50	0.3367
11	Accel	15-60	26	43.42	1.73	0.3136
12	Decel	60-0	21	33.83	-2.86	0.1973
13	Accel	0-60	32	37.27	1.88	0.3313
14	Decel	60-30	23	46.86	-1.30	0.2994
15	Decel	30-15	9	23.18	-1.67	0.0579
16	Decel	15-0	8	7.81	-1.88	0.0173
17	Accel	0-45	22	28.85	2.05	0.1759
18	Decel	45-15	16	31.33	-1.88	0.1392
19	Accel	15-45	18	30.55	1.67	0.1528
20	Decel	45-0	19	24.72	-2.37	0.1304
21	Accel	0-60	25	38.28	2.40	0.2654
22	Decel	60-0	28	33.88	-2.14	0.2634
23	Accel	0-30	15	17.73	2.00	0.0737
24	Accel	30-60	25	45.14	1.20	0.3134
25	Decel	60-30	18	47.23	-1.67	0.2362
26	Decel	30-0	10	15.99	-3.00	0.0444
27	Accel	0-60	38	38.01	1.58	0.4009
28	Decel	60-0	35	33.87	-1.71	0.3293
29	Accel	0-30	18	17.73	1.67	0.0886
30	Accel	30-60	21	44.55	1.43	0.2599
31	Decel	60-30	14	46.63	-2.14	0.1813
32	Decel	30-0	13	16.40	-2.31	0.0592

Table 4

Summary of Modal Results on Diesel Trucks
19 Trucks

Mode NO.	-Emission Results (gm/mi)- HC	CO	CO_2	NOX	MPG
1	1.04	2.88	1069.7	3.27	9.4
2	1.00	1.61	258.6	1.31	38.5
3	1.79	3.89	1088.8	3.73	9.2
4	1.01	2.07	673.7	2.59	15.0
5	.68	1.51	618.2	2.26	16.3
6	.56	1.05	195.3	1.12	51.2
7	.60	2.12	828.8	2.43	12.2
8	.60	1.40	281.0	1.46	35.7
9	.62	1.84	679.7	2.29	14.9
10	.71	1.16	202.2	1.10	49.3
11	.60	2.09	858.1	2.55	11.8
12	.76	1.33	214.1	1.21	46.6
13	.65	2.28	906.1	2.83	11.2
14	.65	1.14	206.1	1.15	48.5
15	.76	1.25	204.5	1.17	48.7
16	1.96	3.25	500.6	2.21	19.9
17	.80	2.15	890.2	2.89	11.4
18	.64	1.14	169.2	.98	58.8
19	.69	1.96	781.5	2.61	12.9
20	.75	1.34	197.7	1.08	50.3
21	.62	2.54	996.5	2.81	10.2
22	.70	1.51	223.0	1.19	44.7
23	1.18	2.77	955.9	3.37	10.6
24	.58	1.73	710.0	2.37	14.2
25	.61	1.13	209.5	1.17	47.7
26	.99	1.73	266.8	1.45	37.3
27	.61	1.97	803.2	2.68	12.6
28	.74	1.35	223.4	1.19	44.7
29	1.19	2.65	861.7	3.21	11.7
30	.60	1.96	765.3	2.39	13.2
31	.59	1.20	218.8	1.23	45.7
32	.94	1.68	258.3	1.36	38.6

APPENDIX A

LISTING OF FEDERAL TEST PROCEDURE RESULTS ON INDIVIDUAL VEHICLES

ST. LOUIS DIESELS

VEH. NO.	MODL YEAR	MAKE	MODL	CID	TEST TYPE	-- EMISSION RESULTS (gm/mi) -- HC	CO	CO_2	NO_{xc}		FUEL ECON MPG
1392	1971	CHEV	C10	350	BASE COLD TRANS	1.40	2.4	648.5	1.35		15.49
IHC:	0 ppm hexane				BASE COLD STABI	1.29	2.1	535.2	1.50		18.76
ICO [act]:	0.1 %CO				BASE HOT TRANS	0.82	1.8	536.2	1.39		18.79
ICO [spec]:	N/A %CO				BASE 75 FTP	1.18	2.1	558.8	1.44		17.99
OTHER TESTS:	HFET, SHORT TESTS, MODAL, DIESEL										
1393	1971	GMC	C150	350	BASE COLD TRANS	0.74	1.6	647.2	1.79		15.60
IHC:	0 ppm hexane				BASE COLD STABI	0.75	1.8	553.9	1.83		18.20
ICO [act]:	0.1 %CO				BASE HOT TRANS	0.48	1.4	518.7	1.64		19.48
ICO [spec]:	N/A %CO				BASE 75 FTP	0.67	1.6	563.5	1.77		17.91
OTHER TESTS:	HFET, SHORT TESTS, MODAL, DIESEL										
1394	1971	CHEV	C10	350	BASE COLD TRANS	1.99	3.4	704.9	1.42		14.20
IHC:	3 ppm hexane				BASE COLD STABI	1.62	3.3	556.5	1.37		17.95
ICO [act]:	0.1 %CO				BASE HOT TRANS	1.27	2.6	563.0	1.29		17.82
ICO [spec]:	N/A %CO				BASE 75 FTP	1.60	3.1	588.8	1.35		17.00
OTHER TESTS:	HFET, SHORT TESTS, MODAL, DIESEL										
1395	1971	GMC	C150	350	BASE COLD TRANS	0.78	1.9	658.8	1.66		15.32
IHC:	6 ppm hexane				BASE COLD STABI	0.54	1.7	560.7	1.80		18.00
ICO [act]:	0.0 %CO				BASE HOT TRANS	0.54	1.6	546.1	1.61		18.49
ICO [spec]:	N/A %CO				BASE 75 FTP	0.59	1.7	576.9	1.72		17.50
OTHER TESTS:	HFET, SHORT TESTS, MODAL, DIESEL										

APPENDIX A

LISTING OF FEDERAL TEST PROCEDURE RESULTS ON INDIVIDUAL VEHICLES

ST. LOUIS DIESELS

VEH. NO.	MODL YEAR	MAKE	MODL	CID	TEST TYPE	-- EMISSION RESULTS (gm/mi) -- HC	CO	CO_2	NO_{xc}		FUEL ECON MPG
1376	1971	GMC	C150	350	BASE COLD TRANS	1.01	2.2	724.6	1.80		13.92
IHC: 3 ppm hexane					BASE COLD STABI	0.91	2.1	603.3	1.90		16.70
ICO [act]: 0.1 %CO					BASE HOT TRANS	0.63	1.7	565.3	1.71		17.85
ICO [spec]: N/A %CO					BASE 75 FTP	0.86	2.0	617.9	1.83		16.31
OTHER TESTS: HFET, SHORT TESTS, MODAL, DIESEL											
1377	1971	CHEV	C10	350	BASE COLD TRANS	1.11	2.3	632.8	1.65		15.90
IHC: 0 ppm hexane					BASE COLD STABI	0.77	2.0	537.1	1.73		18.75
ICO [act]: 0.1 %CO					BASE HOT TRANS	0.63	1.8	529.7	1.62		19.04
ICO [spec]: N/A %CO					BASE 75 FTP	0.80	2.0	554.8	1.68		18.16
OTHER TESTS: HFET, SHORT TESTS, MODAL, DIESEL											
+1378	1971	IH	SCOU	198	BASE COLD TRANS	1.35	2.8	544.4	1.65		18.40
IHC: 22 ppm hexane					BASE COLD STABI	1.67	2.8	454.7	1.85		21.91
ICO [act]: 0.1 %CO					BASE HOT TRANS	1.16	2.6	476.3	1.60		21.02
ICO [spec]: N/A %CO					BASE 75 FTP	1.47	2.8	479.0	1.74		20.85
OTHER TESTS: HFET, SHORT TESTS, MODAL, DIESEL											
1379	1971	GMC	C150	350	BASE COLD TRANS	0.82	1.8	653.9	1.74		15.43
IHC: 0 ppm hexane					BASE COLD STABI	0.62	1.7	541.0	1.78		18.65
ICO [act]: 0.1 %CO					BASE HOT TRANS	0.45	1.4	541.7	1.73		18.66
ICO [spec]: N/A %CO					BASE 75 FTP	0.62	1.6	564.4	1.76		17.88
OTHER TESTS: HFET, SHORT TESTS, MODAL, DIESEL											
+1380	1971	CHEV	C10	350	BASE COLD TRANS	1.23	2.2	673.5	1.63		14.95
IHC: 0 ppm hexane					BASE COLD STABI	1.08	2.0	523.1	1.68		19.21
ICO [act]: 0.1 %CO					BASE HOT TRANS	0.81	1.7	532.4	1.55		18.93
ICO [spec]: N/A %CO					BASE 75 FTP	1.03	1.9	556.6	1.64		18.08
OTHER TESTS: HFET, SHORT TESTS, MODAL, DIESEL											
+1381	1971	IH	TRAV	198	BASE COLD TRANS	2.25	3.7	497.1	2.08		19.95
IHC: 31 ppm hexane					BASE COLD STABI	4.09	3.9	475.8	2.16		20.56
ICO [act]: 0.1 %CO					BASE HOT TRANS	2.67	3.1	450.9	1.96		21.92
ICO [spec]: N/A %CO					BASE 75 FTP	3.33	3.6	473.4	2.09		20.78
OTHER TESTS: HFET, SHORT TESTS, MODAL, DIESEL											
1382	1971	CHEV	C10	350	BASE COLD TRANS	0.54	2.1	694.2	1.71		14.55
IHC: 0 ppm hexane					BASE COLD STABI	0.51	1.8	551.3	1.85		18.31
ICO [act]: 0.1 %CO					BASE HOT TRANS	0.40	1.6	555.3	1.65		18.20
ICO [spec]: N/A %CO					BASE 75 FTP	0.49	1.8	581.8	1.77		17.36
OTHER TESTS: HFET, SHORT TESTS, MODAL, DIESEL											
+1383	1971	IH	SCOU	198	BASE COLD TRANS	0.33	1.4	598.9	2.43		16.90
IHC: 0 ppm hexane					BASE COLD STABI	0.19	1.2	449.3	2.20		22.53
ICO [act]: 0.1 %CO					BASE HOT TRANS	0.22	1.2	490.4	2.25		20.64
ICO [spec]: N/A %CO					BASE 75 FTP	0.22	1.2	491.3	2.26		20.60
OTHER TESTS: HFET, SHORT TESTS, MODAL, DIESEL											

APPENDIX A

LISTING OF FEDERAL TEST PROCEDURE RESULTS ON INDIVIDUAL VEHICLES

ST. LOUIS DIESELS

VEH. NO.	MODL YEAR	MAKE	MODL	CID	TEST TYPE	-- EMISSION RESULTS (gm/mi) -- HC	CO	CO_2	NO_{xc}		FUEL ECON MPG
1384	1971	CHEV	C10	350	BASE COLD TRANS	0.73	2.1	593.2	1.86		16.99
IHC:	0 ppm hexane				BASE COLD STABI	0.69	2.1	536.2	1.99		18.78
ICO [act]:	0.1 %CO				BASE HOT TRANS	0.46	1.7	509.4	1.82		19.82
ICO [spec]:	N/A %CO				BASE 75 FTP	0.64	2.0	540.6	1.92		18.65
OTHER TESTS:	HFET, SHORT TESTS, MODAL, DIESEL										
1385	1971	GMC	C150	350	BASE COLD TRANS	0.78	1.7	624.0	1.63		16.18
IHC:	0 ppm hexane				BASE COLD STABI	0.52	1.5	524.3	1.76		19.26
ICO [act]:	0.1 %CO				BASE HOT TRANS	0.33	1.3	511.2	1.68		19.79
ICO [spec]:	N/A %CO				BASE 75 FTP	0.52	1.5	541.3	1.71		18.66
OTHER TESTS:	HFET, SHORT TESTS, MODAL, DIESEL										
1386	1971	MERB	207D	146	BASE COLD TRANS	0.69	1.6	608.8	2.44		16.58
IHC:	0 ppm hexane				BASE COLD STABI	0.49	1.6	487.0	1.97		20.72
ICO [act]:	0.1 %CO				BASE HOT TRANS	0.27	1.3	525.9	2.35		19.24
ICO [spec]:	N/A %CO				BASE 75 FTP	0.47	1.5	522.7	2.17		19.32
OTHER TESTS:	HFET, SHORT TESTS, MODAL, DIESEL										
1387	1971	GMC	C150	350	BASE COLD TRANS	0.67	1.8	699.2	1.80		14.45
IHC:	3 ppm hexane				BASE COLD STABI	0.58	1.7	603.2	1.92		16.74
ICO [act]:	0.1 %CO				BASE HOT TRANS	0.40	1.5	583.9	1.77		17.32
ICO [spec]:	N/A %CO				BASE 75 FTP	0.55	1.7	617.7	1.86		16.36
OTHER TESTS:	HFET, SHORT TESTS, MODAL, DIESEL										
1388	1971	CHEV	C10	350	BASE COLD TRANS	0.80	2.0	667.0	1.82		15.13
IHC:	3 ppm hexane				BASE COLD STABI	0.54	1.8	579.1	1.91		17.43
ICO [act]:	0.1 %CO				BASE HOT TRANS	0.41	1.5	566.1	1.78		17.86
ICO [spec]:	N/A %CO				BASE 75 FTP	0.56	1.8	593.7	1.86		17.01
OTHER TESTS:	HFET, SHORT TESTS, MODAL, DIESEL										
1389	1971	GMC	C150	350	BASE COLD TRANS	0.73	2.0	633.5	1.93		15.93
IHC:	0 ppm hexane				BASE COLD STABI	0.57	1.9	552.0	2.09		18.28
ICO [act]:	0.1 %CO				BASE HOT TRANS	0.41	1.6	531.2	1.91		19.02
ICO [spec]:	N/A %CO				BASE 75 FTP	0.56	1.8	563.1	2.01		17.92
OTHER TESTS:	HFET, SHORT TESTS, MODAL, DIESEL										
1390	1971	GMC	C150	350	BASE COLD TRANS	0.95	1.8	666.9	1.61		15.13
IHC:	0 ppm hexane				BASE COLD STABI	0.87	1.8	578.8	1.77		17.41
ICO [act]:	0.1 %CO				BASE HOT TRANS	0.53	1.4	502.3	1.43		20.10
ICO [spec]:	N/A %CO				BASE 75 FTP	0.79	1.7	576.1	1.64		17.51
OTHER TESTS:	HFET, SHORT TESTS, MODAL, DIESEL										
1391	1971	CHEV	C10	350	BASE COLD TRANS	0.48	1.8	634.0	1.78		15.94
IHC:	0 ppm hexane				BASE COLD STABI	0.61	1.9	562.1	1.80		17.95
ICO [act]:	0.1 %CO				BASE HOT TRANS	0.44	1.6	548.7	1.77		18.42
ICO [spec]:	N/A %CO				BASE 75 FTP	0.54	1.8	573.2	1.79		17.61
OTHER TESTS:	HFET, SHORT TESTS, MODAL, DIESEL										

Appendix B

Listing of Highway Fuel Economy & Emission Results on Individual Vehicles

St. Louis Diesels

Veh. No.	Model Year	Make	Model	Test I.W. Lbs.	Act. Dyno HP	-Emission Results (gm/mi)- HC	CO	CO_2	NOx	Fuel Econ. MPG
1376	1978	GMC	C150	4500	19.5	0.44	1.2	451.8	1.43	22.36
1377	1978	Chev	C10	4500	19.5	0.48	1.3	435.2	1.51	23.19
+1378	1977	IH	Scout	4500	17.0	1.03	2.3	427.3	1.67	23.44
1379	1979	GMC	C150	4500	19.5	0.38	1.0	455.8	1.61	22.19
+1380	1978	Chev	C10	4500	19.5	0.64	1.2	435.8	1.36	23.14
+1381	1977	IH	Trav	4500	17.0	2.65	3.1	397.0	2.01	24.80
1382	1979	Chev	C10	4500	19.5	0.34	1.2	480.0	1.49	21.07
+1383	1978	IH	Scout	4000	17.0	0.21	1.3	476.2	2.35	21.24
1384	1979	Chev	C10	4500	19.5	0.39	1.3	448.2	1.74	22.54
1385	1979	GMC	C150	4500	19.5	0.29	0.9	430.1	1.57	23.53
1386	1978	Merb	207D	5000	19.5	0.16	0.16	473.3	2.34	21.41
1387	1979	GMC	C150	4500	19.5	0.30	1.0	464.5	1.60	21.79
1388	1979	Chev	C10	4500	19.5	0.28	1.1	489.3	1.62	20.68
1389	1979	GMC	C150	4500	19.5	0.37	1.2	461.1	1.69	21.92
1390	1978	GMC	C150	4500	19.5	0.27	1.1	454.2	1.34	22.28
1391	1979	Chev	C10	4500	19.5	0.56	1.2	456.5	1.61	22.12
1392	1979	Chev	C10	4500	19.5	0.61	1.3	462.2	1.31	21.83
1393	1979	GMC	C150	4500	19.5	0.40	1.0	452.2	1.54	22.36
1394	1978	Chev	C10	4500	19.5	1.34	2.3	498.5	1.19	20.10
1395	1978	GMC	C150	4500	19.5	0.63	1.3	475.6	1.38	21.22

Appendix C

VEH.	YEAR	MAKE	MODL	CID
1376	1978	GMC	C150	350

MODE NO.	HC	CO	CO2	NOX	MPG
Idle	0.17	0.3	65.0	0.21	154.1
5 MPH	1.70	4.9	1162.2	3.40	8.7
10 MPH	0.93	2.6	570.4	2.24	17.6
15 MPH	1.22	1.5	394.6	1.35	25.4
30 MPH	0.69	1.7	407.2	1.78	24.7
45 MPH	0.71	1.3	403.0	1.58	25.0
60 MPH	0.04	1.2	490.6	1.86	20.7

VEH.	YEAR	MAKE	MODL	CID
1377	1978	CHEV	C10	350

HC	CO	CO2	NOX	MPG
0.13	0.4	89.5	0.28	112.5
1.73	5.9	934.7	2.77	10.7
0.82	3.1	505.0	1.99	19.9
0.52	2.4	356.4	1.29	28.1
0.41	1.0	312.4	1.54	32.3
0.67	1.2	381.4	1.77	26.4
0.54	1.3	481.9	1.95	21.0

VEH.	YEAR	MAKE	MODL	CID
+1378	1977	IH	SCOU	198

MODE NO.	HC	CO	CO2	NOX	MPG
Idle	0.00	0.1	29.8	0.22	339.8
5 MPH	0.69	2.5	379.9	2.81	26.4
10 MPH	1.33	3.0	375.7	2.10	26.5
15 MPH	4.63	5.3	414.1	2.27	23.3
30 MPH	2.61	2.6	325.3	1.89	30.1
45 MPH	0.36	2.3	337.9	1.73	29.7
60 MPH	0.23	2.6	472.1	2.28	21.3

VEH.	YEAR	MAKE	MODL	CID
1379	1979	GMC	C150	350

HC	CO	CO2	NOX	MPG
0.17	0.3	89.7	0.32	112.2
1.99	3.5	1059.8	3.52	9.5
0.78	1.8	538.2	2.01	18.7
0.45	1.0	367.2	1.28	27.5
0.31	0.9	324.9	1.56	31.1
0.40	1.0	395.5	1.67	25.6
0.42	0.8	503.2	2.01	20.1

VEH.	YEAR	MAKE	MODL	CID
+1380	1978	CHEV	C10	350

MODE NO.	HC	CO	CO2	NOX	MPG
Idle	0.19	0.5	73.6	0.20	135.9
5 MPH	2.17	5.6	833.7	2.13	12.0
10 MPH	1.19	2.8	520.0	1.91	19.3
15 MPH	0.69	1.4	367.8	1.28	27.3
30 MPH	0.48	0.9	324.7	1.40	31.1
45 MPH	0.58	1.0	384.1	1.47	26.3
60 MPH	0.61	1.2	489.0	1.69	20.6

VEH.	YEAR	MAKE	MODL	CID
+1381	1977	IH	TRAV	198

HC	CO	CO2	NOX	MPG
0.14	0.2	31.6	0.18	314.8
0.83	2.8	428.1	2.63	23.4
6.41	6.3	440.2	2.13	21.6
2.55	4.9	521.5	2.73	18.9
1.85	2.8	372.6	2.12	26.6
1.02	2.4	312.1	2.02	31.9
0.88	3.3	450.1	2.88	22.2

VEH.	YEAR	MAKE	MODL	CID
1382	1979	CHEV	C10	350

MODE NO.	HC	CO	CO2	NOX	MPG
Idle	0.12	0.2	73.8	0.23	136.5
5 MPH	1.28	4.6	840.6	2.62	11.9
10 MPH	0.72	2.1	596.3	2.96	16.9
15 MPH	0.48	1.5	411.9	1.88	24.5
30 MPH	0.41	1.1	351.6	1.75	28.7
45 MPH	0.43	1.1	421.9	1.60	23.9
60 MPH	0.33	1.1	537.0	1.98	18.9

VEH.	YEAR	MAKE	MODL	CID
+1383	1978	IH	SCOU	198

HC	CO	CO2	NOX	MPG
0.07	0.0	34.3	0.33	294.4
0.62	0.4	501.9	4.56	20.2
0.43	2.1	470.1	2.72	21.4
0.27	1.1	324.8	1.97	31.1
0.18	0.9	309.0	1.90	32.7
0.19	1.0	403.2	2.32	25.1
0.48	2.2	555.4	3.71	18.2

EMISSION RESULTS IN GRAMS PER MILE (PER MINUTE FOR IDLE)
FUEL ECONOMY IN MILES PER GALLON (MINUTES PER GALLON FOR IDLE)

Appendix C

	VEH.	YEAR	MAKE	MODL	CID
	1384	1979	CHEV	C10	350

MODE NO.	HC	CO	CO2	NOX	MPG
Idle	0.11	0.6	87.7	0.35	114.4
5 MPH	1.01	6.8	1000.9	4.04	10.0
10 MPH	0.69	4.1	570.0	3.40	17.6
15 MPH	0.43	1.9	385.8	2.09	26.1
30 MPH	0.30	1.5	334.3	1.79	30.1
45 MPH	0.36	1.5	386.4	1.87	26.1
60 MPH	0.49	1.2	501.8	2.41	20.1

	VEH.	YEAR	MAKE	MODL	CID
	1385	1979	GMC	C150	350

HC	CO	CO2	NOX	MPG
0.12	0.3	83.7	0.34	120.3
1.18	4.2	971.0	3.81	10.4
0.56	1.6	519.3	2.62	19.4
0.36	0.8	354.7	1.60	28.5
0.22	0.7	316.6	1.69	32.0
0.16	0.9	378.7	1.81	26.7
0.32	0.9	466.3	2.10	21.7

	VEH.	YEAR	MAKE	MODL	CID
	1386	1978	MERB	207D	146

MODE NO.	HC	CO	CO2	NOX	MPG
Idle	0.02	0.2	29.3	0.17	342.1
5 MPH	0.76	4.2	688.1	2.85	14.6
10 MPH	0.37	1.8	413.2	1.74	24.4
15 MPH	0.34	2.8	467.4	1.90	21.5
30 MPH	0.19	1.5	390.3	1.96	25.9
45 MPH	0.11	1.2	383.4	2.32	26.4
60 MPH	0.13	1.1	553.7	3.89	18.3

	VEH.	YEAR	MAKE	MODL	CID
	1387	1979	GMC	C150	350

HC	CO	CO2	NOX	MPG
0.16	0.4	96.2	0.40	104.5
1.60	5.3	1119.9	4.68	9.0
0.80	1.6	581.7	2.50	17.3
0.47	1.1	399.4	1.70	25.3
0.30	0.8	343.6	1.69	29.4
0.21	0.8	402.2	1.86	25.2
0.34	0.9	504.4	2.24	20.1

	VEH.	YEAR	MAKE	MODL	CID
	1388	1979	CHEV	C10	350

MODE NO.	HC	CO	CO2	NOX	MPG
Idle	0.01	0.2	90.7	0.40	111.7
5 MPH	1.33	4.3	1054.0	4.57	9.6
10 MPH	0.67	2.9	557.5	2.71	18.0
15 MPH	0.39	1.9	402.5	1.87	25.0
30 MPH	0.28	1.0	362.1	1.70	27.9
45 MPH	0.31	1.1	428.8	1.90	23.6
60 MPH	0.39	1.2	520.1	2.18	19.4

	VEH.	YEAR	MAKE	MODL	CID
	1389	1979	GMC	C150	350

HC	CO	CO2	NOX	MPG
0.10	0.4	83.7	0.37	120.4
0.97	3.2	961.6	4.41	10.5
0.92	2.2	451.2	2.04	22.2
0.65	1.8	396.7	2.03	25.3
0.26	1.1	347.5	2.00	29.1
0.31	1.2	402.7	1.96	25.1
0.42	1.1	512.0	2.32	19.8

	VEH.	YEAR	MAKE	MODL	CID
	1390	1978	GMC	C150	350

MODE NO.	HC	CO	CO2	NOX	MPG
Idle	0.01	0.4	87.9	0.28	114.7
5 MPH	2.00	4.6	991.7	3.05	10.1
10 MPH	0.75	1.8	519.2	2.06	19.4
15 MPH	0.74	2.6	507.8	2.29	19.8
30 MPH	0.57	1.7	381.2	1.63	26.4
45 MPH	0.40	1.1	390.1	1.56	25.9
60 MPH	0.42	1.2	496.7	1.83	20.4

	VEH.	YEAR	MAKE	MODL	CID
	1391	1979	CHEV	C10	350

HC	CO	CO2	NOX	MPG
0.15	0.4	89.2	0.33	112.8
1.59	5.3	1040.6	3.63	9.7
0.79	2.3	550.3	2.50	18.3
0.51	1.1	389.9	1.61	25.9
0.39	1.0	338.0	1.73	29.9
0.44	1.0	390.9	1.77	25.8
0.49	1.1	487.6	2.09	20.7

EMISSION RESULTS IN GRAMS PER MILE (PER MINUTE FOR IDLE)
FUEL ECONOMY IN MILES PER GALLON (MINUTES PER GALLON FOR IDLE)

Appendix C

VEH.	YEAR	MAKE	MODL	CID
1392	1979	CHEV	C10	350

MODE NO.	HC	CO	CO2	NOX	MPG
Idle	0.13	0.3	89.1	0.31	113.1
5 MPH	1.96	5.4	1056.8	3.50	9.5
10 MPH	0.91	1.8	500.3	1.58	20.1
15 MPH	0.51	1.8	374.0	1.47	26.9
30 MPH	0.47	1.6	330.1	1.49	30.5
45 MPH	0.52	1.2	396.3	1.54	25.5
60 MPH	0.63	1.2	524.6	1.80	19.3

VEH.	YEAR	MAKE	MODL	CID
1393	1979	GMC	C150	350

HC	CO	CO2	NOX	MPG
0.00	0.3	85.6	0.28	118.2
1.61	6.7	984.7	3.17	10.2
0.81	2.3	571.3	2.35	17.6
0.50	1.8	395.3	1.53	25.5
0.36	1.1	336.4	1.61	30.0
0.37	0.9	385.7	1.70	26.2
0.44	0.7	480.7	1.24	21.1

VEH.	YEAR	MAKE	MODL	CID
1394	1978	CHEV	C10	350

MODE NO.	HC	CO	CO2	NOX	MPG
Idle	0.26	0.6	71.2	0.15	139.5
5 MPH	2.75	6.8	750.3	1.45	13.2
10 MPH	1.59	4.7	595.0	1.72	16.8
15 MPH	0.93	2.8	399.6	1.09	25.0
30 MPH	0.86	1.9	341.7	1.13	29.3
45 MPH	1.17	2.0	406.9	1.28	24.6
60 MPH	0.38	2.2	578.8	1.68	17.4

VEH.	YEAR	MAKE	MODL	CID
1395	1978	GMC	C150	350

HC	CO	CO2	NOX	MPG
0.11	0.4	88.3	0.29	113.9
1.27	5.1	1029.3	3.33	9.8
0.63	2.0	482.4	1.58	20.9
0.49	1.3	389.7	1.69	25.9
0.36	0.9	337.6	1.57	29.9
0.54	1.1	404.8	1.58	24.9
0.76	1.3	534.7	1.86	18.9

EMISSION RESULTS IN GRAMS PER MILE (PER MINUTE FOR IDLE)
FUEL ECONOMY IN MILES PER GALLON (MINUTES PER GALLON FOR IDLE)

APPENDIX D

LISTING OF FEDERAL SHORT CYCLE EMISSION RESULTS ON INDIVIDUAL VEHICLES

ST. LOUIS DIESELS

VEH. NO.	MODL YEAR	MAKE	MODL	CID	SEQ.	- EMISSION RESULTS (gm/mi)- HC	CO	CO_2	NO_{xc}	FUEL ECON MPG
1376	1978	GMC	C150	350	BASE	0.74	1.9	456.7	1.44	22.02
1377	1978	CHEV	C10	350	BASE	0.59	1.6	418.9	1.39	24.04
+1378	1977	IH	SCOU	198	BASE	1.43	2.5	377.6	1.41	26.36
1379	1979	GMC	C150	350	BASE	0.59	1.6	434.6	1.54	23.18
+1380	1978	CHEV	C10	350	BASE	0.86	1.6	404.6	1.29	24.83
+1381	1977	IH	TRAV	198	BASE	3.30	2.8	371.2	1.62	26.35
1382	1979	CHEV	C10	350	BASE	0.51	1.5	447.4	1.51	22.54
+1383	1978	IH	SCOU	198	BASE	0.20	1.0	374.5	1.74	27.02
1384	1979	CHEV	C10	350	BASE	0.46	1.7	421.5	1.58	23.91
1385	1979	GMC	C150	350	BASE	0.39	1.2	409.8	1.45	24.64
1386	1978	MERB	207D	146	BASE	0.27	1.4	409.4	1.71	24.67
1387	1979	GMC	C150	350	BASE	0.47	1.4	456.2	1.51	22.13
1388	1979	CHEV	C10	350	BASE	0.32	1.5	479.1	1.55	21.09
1389	1979	GMC	C150	350	BASE	0.34	1.5	441.1	1.67	22.89
1390	1978	GMC	C150	350	BASE	0.37	1.5	439.9	1.32	22.95
1391	1979	CHEV	C10	350	BASE	0.59	1.6	434.6	1.48	23.18
1392	1979	CHEV	C10	350	BASE	0.72	1.7	442.2	1.23	22.76
1393	1979	GMC	C150	350	BASE	0.52	1.5	435.2	1.44	23.17
1394	1978	CHEV	C10	350	BASE	1.36	2.6	445.6	1.05	22.42
1395	1978	GMC	C150	350	BASE	0.51	1.4	375.7	1.17	26.81

APPENDIX E

LISTING OF IDLE EMISSION RESULTS ON INDIVIDUAL VEHICLES

ST. LOUIS DIESELS

VEH. NO.	MODL YEAR	MAKE	MODL	CID	SEQ.	IDLE HC ppmh	IDLE CO %	IDLE NO ppm
1376	1978	GMC	C150	350	BASE	3	0.08	39
1377	1978	CHEV	C10	350	BASE	0	0.08	37
+1378	1977	IH	SCOU	198	BASE	21	0.05	93
1379	1979	GMC	C150	350	BASE	0	0.07	39
+1380	1978	CHEV	C10	350	BASE	0	0.09	32
+1381	1977	IH	TRAV	198	BASE	30	0.10	44
1382	1979	CHEV	C10	350	BASE	1	0.08	67
+1383	1978	IH	SCOU	198	BASE	0	0.06	128
1384	1979	CHEV	C10	350	BASE	0	0.07	69
1385	1979	GMC	C150	350	BASE	0	0.06	61
1386	1978	MERB	207D	146	BASE	1	0.05	98
1387	1979	GMC	C150	350	BASE	4	0.09	75
1388	1979	CHEV	C10	350	BASE	2	0.05	62
1389	1979	GMC	C150	350	BASE	0	0.06	56
1390	1978	GMC	C150	350	BASE	1	0.07	40
1391	1979	CHEV	C10	350	BASE	0	0.07	53
1392	1979	CHEV	C10	350	BASE	0	0.06	29
1393	1979	GMC	C150	350	BASE	0	0.07	48
1394	1978	CHEV	C10	350	BASE	3	0.10	27
1395	1978	GMC	C150	350	BASE	5	0.04	55

APPENDIX F

LISTING OF FEDERAL THREE MODE EMISSION RESULTS ON INDIVIDUAL VEHICLES

ST. LOUIS DIESELS

VEH. NO.	MODL YEAR	MAKE	MODL	CID	SEQ.	MODE	RLHP	HC ppmh	CO %	NO ppm
1376	1978	GMC	C150	350	BASE	52 MPH	25.0	0	0.06	148
					BASE	25 MPH	10.0	0	0.05	141
					BASE	IDLE (D)		0	0.06	88
					BASE	IDLE (N)		0	0.05	46
1377	1978	CHEV	C10	350	BASE	52 MPH	25.0	0	0.07	160
					BASE	25 MPH	10.0	0	0.07	139
					BASE	IDLE (D)		0	0.07	82
					BASE	IDLE (N)		0	0.06	45
+1378	1977	IH	SCOU	198	BASE	52 MPH	22.9	0	0.13	309
					BASE	25 MPH	10.0	0	0.05	291
					BASE	IDLE (N)		0	0.06	128
1379	1979	GMC	C150	350	BASE	52 MPH	25.0	0	0.04	169
					BASE	25 MPH	10.0	0	0.04	148
					BASE	IDLE (D)		0	0.04	98
					BASE	IDLE (N)		0	0.04	43
+1380	1978	CHEV	C10	350	BASE	52 MPH	25.0	0	0.08	140
					BASE	25 MPH	10.0	0	0.08	135
					BASE	IDLE (D)		0	0.08	77
					BASE	IDLE (N)		0	0.09	40
+1381	1977	IH	TRAV	198	BASE	52 MPH	22.9	43	0.11	329
					BASE	25 MPH	10.0	22	0.05	291
					BASE	IDLE (N)		18	0.06	61
1382	1979	CHEV	C10	350	BASE	52 MPH	25.0	3	0.08	154
					BASE	25 MPH	10.0	6	0.08	155
					BASE	IDLE (D)		6	0.08	102
					BASE	IDLE (N)		6	0.08	72
+1383	1978	IH	SCOU	198	BASE	52 MPH	22.0	0	0.08	388
					BASE	25 MPH	9.0	0	0.06	319
					BASE	IDLE (D)		0	0.05	249
					BASE	IDLE (N)		0	0.06	151
1384	1979	CHEV	C10	350	BASE	52 MPH	25.0	2	0.05	174
					BASE	25 MPH	10.0	3	0.05	164
					BASE	IDLE (D)		5	0.05	99
					BASE	IDLE (N)		4	0.04	71
1385	1979	GMC	C150	350	BASE	52 MPH	25.0	0	0.06	193
					BASE	25 MPH	10.0	0	0.05	167
					BASE	IDLE (D)		0	0.05	115
					BASE	IDLE (N)		0	0.05	61
1386	1978	MERB	207D	146	BASE	52 MPH	25.0	0	0.07	435
					BASE	25 MPH	11.0	0	0.05	299
					BASE	IDLE (N)		0	0.05	110

APPENDIX F

LISTING OF FEDERAL THREE MODE EMISSION RESULTS ON INDIVIDUAL VEHICLES

ST. LOUIS DIESELS

VEH. NO.	MODL YEAR	MAKE	MODL	CID	SEQ.	MODE	RLHP	HC ppmh	CO %	NO ppm
1387	1979	GMC	C150	350	BASE	52 MPH	25.0	0	0.09	188
					BASE	25 MPH	10.0	7	0.09	158
					BASE	IDLE (D)		8	0.09	135
					BASE	IDLE (N)		10	0.09	88
1388	1979	CHEV	C10	350	BASE	52 MPH	25.0	4	0.06	195
					BASE	25 MPH	10.0	7	0.06	154
					BASE	IDLE (D)		8	0.06	117
					BASE	IDLE (N)		8	0.05	64
1389	1979	GMC	C150	350	BASE	52 MPH	25.0	0	0.07	178
					BASE	25 MPH	10.0	2	0.06	167
					BASE	IDLE (D)		5	0.06	117
					BASE	IDLE (N)		4	0.06	65
1390	1978	GMC	C150	350	BASE	52 MPH	25.0	0	0.05	152
					BASE	25 MPH	10.0	0	0.05	147
					BASE	IDLE (D)		0	0.05	83
					BASE	IDLE (N)		0	0.05	44
1391	1979	CHEV	C10	350	BASE	52 MPH	25.0	0	0.06	175
					BASE	25 MPH	10.0	1	0.06	151
					BASE	IDLE (D)		2	0.06	106
					BASE	IDLE (N)		3	0.05	53
1392	1979	CHEV	C10	350	BASE	52 MPH	25.0	0	0.05	89
					BASE	25 MPH	10.0	0	0.04	92
					BASE	IDLE (D)		0	0.05	55
					BASE	IDLE (N)		0	0.04	32
1393	1979	GMC	C150	350	BASE	52 MPH	25.0	0	0.06	180
					BASE	25 MPH	10.0	0	0.05	166
					BASE	IDLE (D)		0	0.06	104
					BASE	IDLE (N)		0	0.06	54
1394	1978	CHEV	C10	350	BASE	52 MPH	25.0	0	0.10	114
					BASE	25 MPH	10.0	0	0.08	113
					BASE	IDLE (D)		8	0.09	59
					BASE	IDLE (N)		8	0.10	36
1395	1978	GMC	C150	350	BASE	52 MPH	25.0	0	0.06	134
					BASE	25 MPH	10.0	0	0.05	147
					BASE	IDLE (D)		0	0.06	84
					BASE	IDLE (N)		0	0.05	56

APPENDIX G

LISTING OF VEHICLE DRIVEABILITY PROBLEMS AND MAINTENANCE INFORMATION

ST. LOUIS DIESELS

VEH. NO.	MODL YEAR	MAKE	MODL	MAINTENANCE CAT	FE	CF	DRIVEABILITY PROBLEMS REPAIRS	TYPE	WHEN	EFFECT
1376	1978	GMC	C150	1	N	Y	NO			
1377	1978	CHEV	C10	1	Y	Y	YES	2	4	2
1378	1977	IH	SCOU	1	Y	Y	NO			
1379	1979	GMC	C150	1	N	Y	NO			
1380	1978	CHEV	C10	1	N	Y	NO			
1381	1977	IH	TRAV	1	Y	N	YES	6	4	2
1382	1979	CHEV	C10	1	N	Y	NO			
1383	1978	IH	SCOU	1	Y	Y	NO			
1384	1979	CHEV	C10	1	N	N	NO			
1385	1979	GMC	C150	1	N	Y	YES	6	4	2
1386	1978	MERB	207D	1	Y	N	NO			
1387	1979	GMC	C150	1	N	Y	NO			
1388	1979	CHEV	C10	1	Y	N	YES	2	2	2
1389	1979	GMC	C150	1	N	Y	NO			
1390	1978	GMC	C150	1	N	Y	YES	6	2	2
1391	1979	CHEV	C10	1	N	Y	NO			
1392	1979	CHEV	C10	1	Y	N	YES	3	2	2
1393	1979	GMC	C150	1	Y	N	YES	6	3	2
1394	1978	CHEV	C10	1	N	N	NO			
1395	1978	GMC	C150	1	N	N	YES	3	4	2

MAINTENANCE INFORMATION

CAT - Has the catalytic converter ever been replaced on this vehicle (1: no catalyst; 2: yes; 3: no; 4: don't know)
Note: If catalytic converter has been removed, question is answered 'no'.

FE - Do you accurately keep records of the fuel economy on this vehicle (Y: yes; N: no)

CF - Are you concerned with the fuel economy of this vehicle (Y: yes; N: no)

DRIVEABILITY PROBLEMS

REPAIRS - Have you had any repairs to your vehicle for the correction of driveability problems

TYPE - What repairs were performed on your vehicle to correct driveability problems (1: none; 2: Injector ; 3: engine; 4: emission control; 5: ignition system; 6: other; 7: don't know)

WHEN - How long ago were these repairs accomplished? (1: no repairs; 2: 0-3 months; 3: 3-6 months; 4: over 6 months; 5: don't know)

EFFECT - Were these repairs effective in correcting the driveability problems? (1: no repair; 2: yes; 3: no)

Appendix G

Vehicle No.	Year	Make	Model	Odometer	VIN	Driving Pattern					Driving Purpose				Distance Between Home and Lab	Number of Times Engine is Started Per Day	Owner Estimate		
						City Expressway	Major City St.	Other City St.	Rural Expressway	Other Rural Road	Work	Shopping	Non-Work Business	Other			City Driving	Highway Driving	Combined
1376	78	GMC	C150	49842	TCZ148S521094	L	L	S	S	L	S	L	L	S	12	4	-	-	18
1377	78	Chev	C10	33498	CCZ1485198744	A	S	L	L	L	A	L	L	L	24	6	-	-	15
1378	77	IH	Scout	40819	G0063GGD5302	A	L	L	L	S	L	A	L	S	35	6	-	-	25
1379	79	GMC	C150	8568	TCZ149S522640	L	S	L	S	L	S	L	L	S	10	8	19	24	-
1380	78	Chev	C10	8466	CCZ148S215995	L	A	S	L	L	L	S	A	L	9	4	-	-	-
1381	77	IH	Trav	91760	G0103GGD30567	L	L	L	A	L	L	L	A	L	20	4	22	23	-
1382	79	Chev	C10	7863	CCZ149S118976	L	L	L	S	S	L	S	L	S	30	2	-	-	20
1383	78	IH	Scout	22358	H0103HGD46422	A	L	L	L	L	L	L	S	S	15	6	18	25	-
1384	79	Chev	C10	11823	CCZ1495188762	L	A	L	L	L	S	S	L	L	13	4	-	-	24
1385	79	GMC	C150	16627	TCZ149J508787	L	A	S	L	L	A	L	L	L	5	6	-	-	18
1386	78	Merb	207D	13402	6015011801943	S	L	L	M	S	L	L	L	A	99	16	-	-	26
1387	79	GMC	C150	11475	TCZ149J518040	A	L	L	L	L	A	L	L	L	17	2	-	23	-
1388	79	Chev	C10	4466	CCZ149J185893	L	A	L	L	L	S	L	S	L	7	6	-	19	-
1389	79	GMC	C150	5951	TCZ149S528508	A	L	S	L	L	A	S	L	L	29	4	-	20	-
1390	78	GMC	C150	27480	TCZ148S534191	M	S	S	L	L	L	A	L	S	12	4	-	-	19
1391	79	Chev	C10	10378	CCZ149S187323	M	S	S	L	L	L	L	A	L	2	12	20	-	-
1392	79	Chev	C10	7920	CCZ149S148145	L	L	S	S	L	S	L	S	L	20	6	-	-	18
1393	79	GMC	C150	10867	TCZ149S517001	M	S	L	S	L	A	L	A	L	7	6	-	-	21
1394	78	Chev	C10	48104	CCZ148S183967	A	L	L	L	L	A	L	A	L	18	20	-	20	-
1395	78	GMC	C150	37727	TCZ148S528924	A	L	L	L	L	A	L	A	L	18	16	-	-	-
			Avg.	23469															

Legend:
- L: Little (less than 20%)
- S: Some (21% to 50%)
- M: Most (51% to 75%)
- A: All (more than 75%)

Appendix G

Vehicle No.	Year	Make	Model	Any Performance Problems	Area of Problem	Satisfied with Performance	How Often is Vehicle Tuned-Up (Months)?	How Long Ago was Last Tune-Up?	Who Performed this Tune-Up?	How Long Ago was Last Oil Changed (Months)?	Vehicle Maintained within Manufacturer's Recommendations	How Many Drive-Train Related Warranty Repairs	Nature of Warranty Repair	Brand Name of Fuel	Any Major Damage
1376	78	GMC	C150	No	NA	Mostly	12-24	Too New	Never	Unknown	Yes	3+	Inj. P, Inj., O.L.	Mobil	No
1377	78	Chev	C10	No	NA	Yes	12	6-12	Self	0-6	Yes	3+	TR, Inj. P.,	Bonafide	Yes
1378	77	IH	Scout	Yes	HS,RI,PA,P	Yes	0-6	6-12	Self	0-6	Yes	3+	O.L.	Texaco	No
1379	79	GMC	C150	No	NA	Yes	None	Too new	Never	0-6	Yes	None	NA	Unknown	No
1380	78	Chev	C10	Yes	P.	Yes	None	Too new	Never	Unknown	Yes	None	NA	Kerr-McGee	No
1381	77	IH	Trav	No	NA	Yes	None	Too new	Never	0-6	No	None	NA	Texaco	No
1382	79	Chev	C10	No	NA	Yes	None	Too new	Never	0-6	Yes	None	NA	Amoco	No
1383	78	IH	Scout	No	NA	Yes	None	Too new	Never	0-6	Yes	None	NA	Various	No
1384	79	Chev	C10	Yes	RI, PA, S.	Yes	None	Too new	Never	0-6	Yes	None	NA	Various	No
1385	79	GMC	C150	Yes	S	Mostly	Unknown	Unknown	Unknown	0-6	Yes	3+	Inj.	Unknown	No
1386	78	Merb	207D	No	NA	Yes	12	0-6	Clinic	0-6	Yes	1	O.L.	Freedom	No
1387	79	GMC	C150	No	NA	No	None	Too new	Never	0-6	Yes	None	NA	Various	No
1388	79	Chev	C10	No	NA	Yes	None	Too New	Never	0-6	Yes	3+	Inj.	Zephyr	No
1389	79	GMC	C150	No	NA	Yes	None	Too New	Never	0-6	Yes	1	HPL	Texaco	No
1390	78	GMC	C150	No	NA	Mostly	12-24	0-6	dealer	0-6	Yes	3+	O.L., Inj.*	Unknown	No
1391	79	Chev	C10	No	NA	Yes	12	0-6	Self	0-6	Yes	3+	O.L.	Phillips	No
1392	79	Chev	C10	No	NA	No	None	Too New	Never	0-6	Yes	3+	Inj. P., P., O.L.	Phillips	No
1393	79	GMC	C150	Yes	NA	Mostly	0-6	0-6	Garage	0-6	Yes	2	TR.	Various	No
1394	78	Chev	C10	Yes	NA	Mostly	12	6-12	Self	0-6	Yes	None	NA	Various	No
1395	78	GMC	C150	No	NA	Yes	12	0-6	Self	0-6	Yes	None	**	Various	No

H.S.: Hard Starting
P.A.: Poor Acceleration
Inj.: Injectors
T.C.L.: Transmission Cooling Line
F.P.: Fuel Pump

R.I.: Rough Idle
D.: Driveability
O.L.: Oil Leaks
P.: Ping
S.: Stumbling

Inj. P: Replaced Injector Pump
TR: Transmission
HPL: High Pressure Line
P: Piston

* Engine Rebuilt at 21,000 miles

** Had new engine installed